

Semantic Web Technologies I

Lehrveranstaltung im WS08/09

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Anwendungen



Einleitung und Ausblick

XML und URIs

Einführung in RDF

RDF Schema

Logik - Grundlagen

Semantik von RDF(S)

OWL - Syntax und Intuition

OWL - Semantik und Reasoning

SPARQL - Syntax und Intuition

Semantik von SPARQL

Konjunktive Anfragen/Regelsprachen

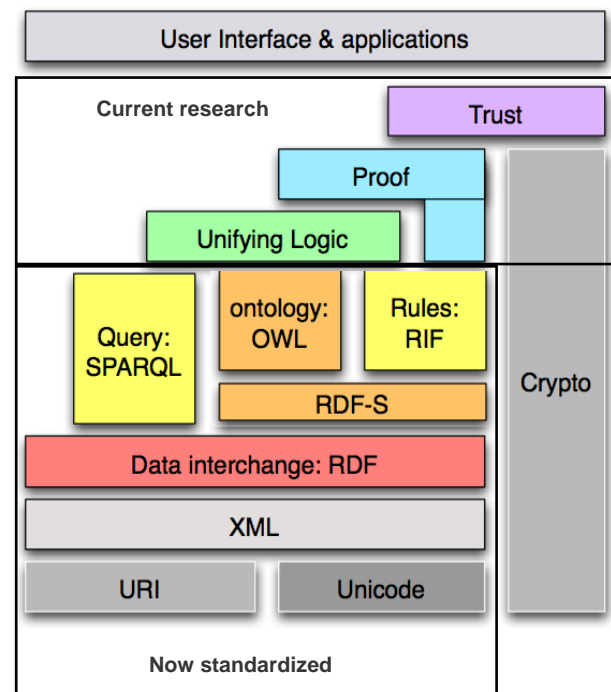
Regeln im Semantic Web

Bericht aus der Praxis

OWL 2 - Syntax und Semantik

Semantic Web – Anwendungen

Semantic Web Architecture



Anwendungen

- Wann ist eine "Anwendung" eine "Anwendung semantischer Technologien"?
- Was sind "semantische Technologien"?
- Und was nicht?
- Wer entscheidet das?

Aus der Anfangsvorlesung

➤ Lösungsansatz für Probleme des Web:

II. A priori: Strukturierung der Web-Informationen zur Erleichterung der automatisierten Auswertung:

→ **Semantic Web**

Zwei essentielle Voraussetzungen zur Realisierung:

1. offene Standards zur Beschreibung von Informationen / von Wissen

Metadaten

2. Methoden zur Gewinnung von weiteren Informationen aus derlei Beschreibungen

➤ **Metadaten und deren Verwendung!**

Metadaten



- Machen Metadaten das Semantic Web?
 - ⇒ Nein, Metadaten sind einfach nur mehr Daten.
 - ⇒ Es kommt auf die Verwendung an.

 - ⇒ Aber Metadaten sind die Grundlage!

- "Semantische" Verwendung von Metadaten
 - ⇒ integrieren
 - ⇒ kombinieren
 - ⇒ auswerten

 - ⇒ Logik wird nicht immer benötigt (manchmal aber schon)

Verwendung von Standards



- Müssen "Anwendungen semantischer Technologien" unbedingt standardisierte Sprachen verwenden?
 - ⇒ Nein, zentral ist die Verwendung von Metadaten und deren semantische Verwendung
 - ⇒ Dennoch empfiehlt sich die Verwendung von Standards.
 - ⇒ Manche Anwendungen sind "semantisch" obwohl der Hersteller das gar nicht so sehen will. 😊

Wer stellt Metadaten zur Verfügung?



- Klassisch:
Metadaten werden mit konkreter Anwendungsabsicht hergestellt bzw. bereitgestellt.
- Webstyle:
Man macht halt mal Metadaten, die sinnvoll erscheinen, es wird sich schon eine Verwendung und ein Mehrwert finden.
- Die Wahrheit liegt vermutlich irgendwo in der Mitte.

Wer macht Metadaten?

Das Henne-Ei-Problem



➤ Klassisch

- ⇒ Bringt die Herstellung von Metadaten zusammen mit zugehörigen Anwendungen genug Mehrwert, damit sich der zusätzliche Aufwand lohnt?

➤ Webstyle

- ⇒ Der Aufwand, öffentliche Metadaten zu erstellen, lohnt sich erst wenn es semantische Anwendungen dafür gibt.
- ⇒ Der Aufwand, semantische Anwendungen zu erstellen, lohnt sich erst wenn es öffentliche Metadaten dafür gibt.

Anwendungskategorien

- Große Vision (Zukunftsmusik)
- Anwendungsszenarien (vielleicht bald in Reichweite)
- Prototypische Anwendung (z.B. in einem Forschungsprojekt)
- Echte Anwendung (in der Praxis verwendet)

Große Vision (Berners-Lee et al. 2001)

- A
- The entertainment system was belting out the Beatles' "We Can Work It Out" when the phone rang. When Pete answered, his phone turned the sound down by sending a message to all the other *local* devices that had a *volume control*. His sister, Lucy, was on the line from the doctor's office: "Mom needs to see a specialist and then has to have a series of physical therapy sessions. Biweekly or something. I'm going to have my agent set up the appointments." Pete immediately agreed to share the chauffeuring. At the doctor's office, Lucy instructed her Semantic Web agent through her handheld Web browser. The agent promptly retrieved information about Mom's *prescribed treatment* from the doctor's agent, looked up several lists of *providers*, and checked for the ones *in-plan* for Mom's insurance within a *20-mile radius* of her *home* and with a *rating* of *excellent* or *very good* on trusted rating services. It then began trying to find a match between available *appointment times* (supplied by the agents of individual providers through their Web sites) and Pete's and Lucy's busy schedules. (The emphasized keywords indicate terms whose semantics, or meaning, were defined for the agent through the Semantic Web.)
 - In a few minutes the agent presented them with a plan. Pete didn't like it; University Hospital was all the way across town from Mom's place, and he'd be driving back in the middle of rush hour. He set his own agent to redo the search with stricter preferences about *location* and *time*. Lucy's agent, having *complete trust* in Pete's agent in the context of the present task, automatically assisted by supplying access certificates and shortcuts to the data it had already sorted through.
 - Almost instantly the new plan was presented: a much closer clinic and earlier times; but there were two warning notes. First, Pete would have to reschedule a couple of his *less important* appointments. He checked what they were; not a problem. The other was something about the insurance company's list failing to include this provider under *physical therapists*: "Service type and insurance plan status securely verified by other means," the agent reassured him. "(Details?)"
 - Lucy registered her assent at about the same moment Pete was muttering, "Spare me the details," and it was all set. (Of course, Pete couldn't resist the details and later that night had his agent explain how it had found that provider even though it wasn't on the proper list.)

Große Vision



[Berners-Lee, Hendler, Lassila, 2001]:

“A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities”

“Computers will find the meaning of semantic data by following hyperlinks to definitions of key terms and rules for reasoning about them logically.”

“Naturally, you want to check this, so your computer asks the service for a proof of its answer, which it promptly provides by translating its internal reasoning into the Semantic Web’s unifying language.”

Es empfiehlt sich, mal den Originalartikel zu lesen.

(Diese) große Vision



- Das dauert noch ein Weilchen ...
- An vielen Stellen dieser großen Vision wird noch geforscht, aber es geht natürlich nur in kleinen Schritten voran.
- Wichtig ist, dass kleine Schritte gefunden werden, die auch jetzt schon Mehrwert liefern.

Beispielhafte Anwendungsszenarien



- Intelligente Unterstützung bei der Informationsintegration
- Automatische flexible Nutzung von Web Services
- Semantische Suche im WWW oder auf dem eigenen Computer
- Webunterstützte wissenschaftliche Zusammenarbeit
- etc.

Prototypische Anwendungen aus Forschungsprojekten

- SmartWeb: Interaktives Frage-Antwortsystem
- NeOn: Überwachung weltweiter Fischbestände bei der FAO (UN Food and Agriculture Organisation)
- SEKT: Semantische Suche in digitalen Bibliotheken
- Nepomuk: Realisierung eines semantischen Desktops
- X-Media: Überwachung des Lebenszyklus von Industrieproduktion mithilfe von Multimediatechnologien
- Realisiert als Forschungsprototypen

SmartWeb: Mobile Querying of the Semantic Web



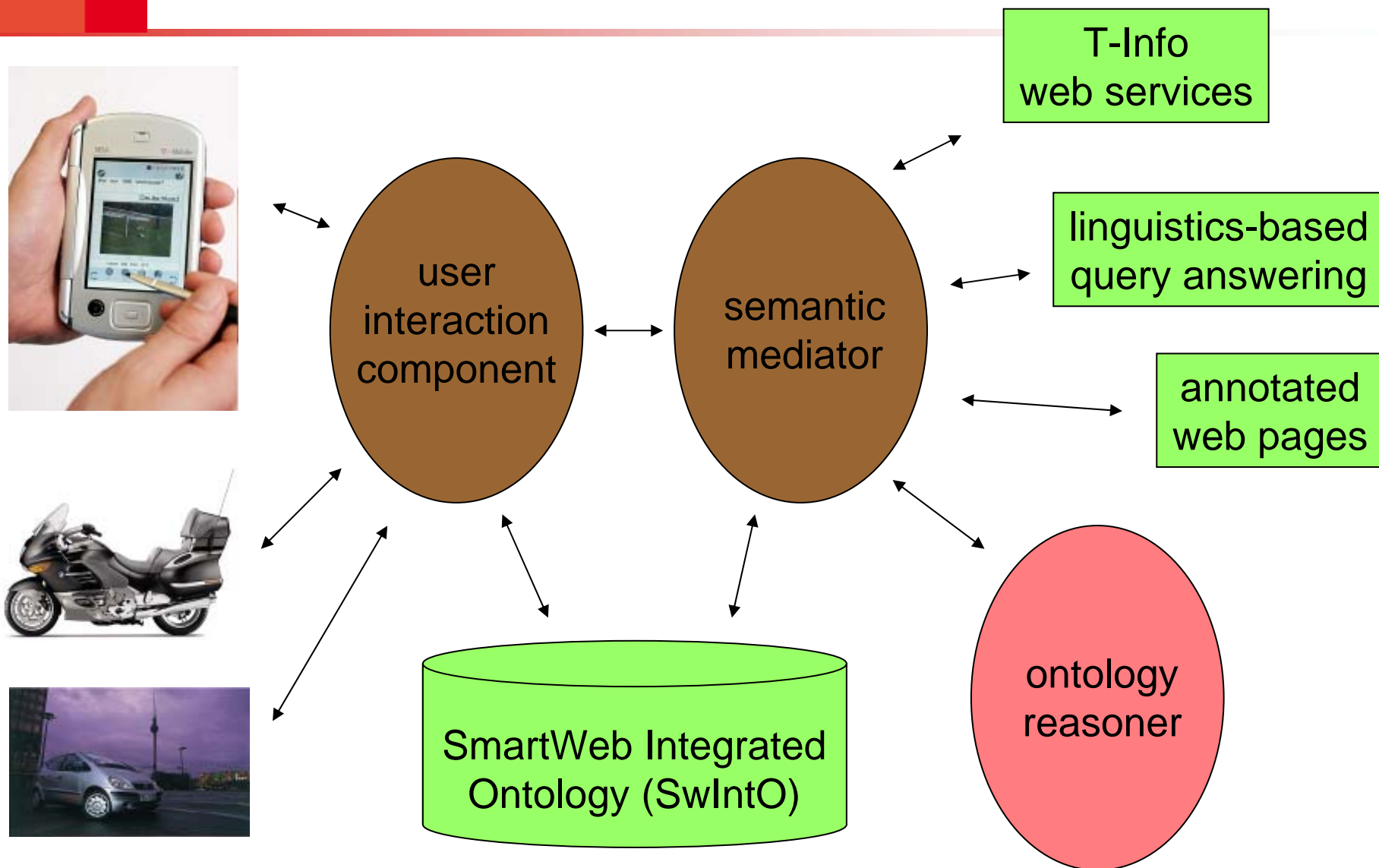
SmartWeb



➤ Demo-Film unter

➤ <http://smartweb.dfki.de/Videos/smartweb-demo-aifb-june-2006.mov>

The SmartWeb System



Echte Anwendungen



- Siehe z.B. auch Sitzung vom 28.01.2009

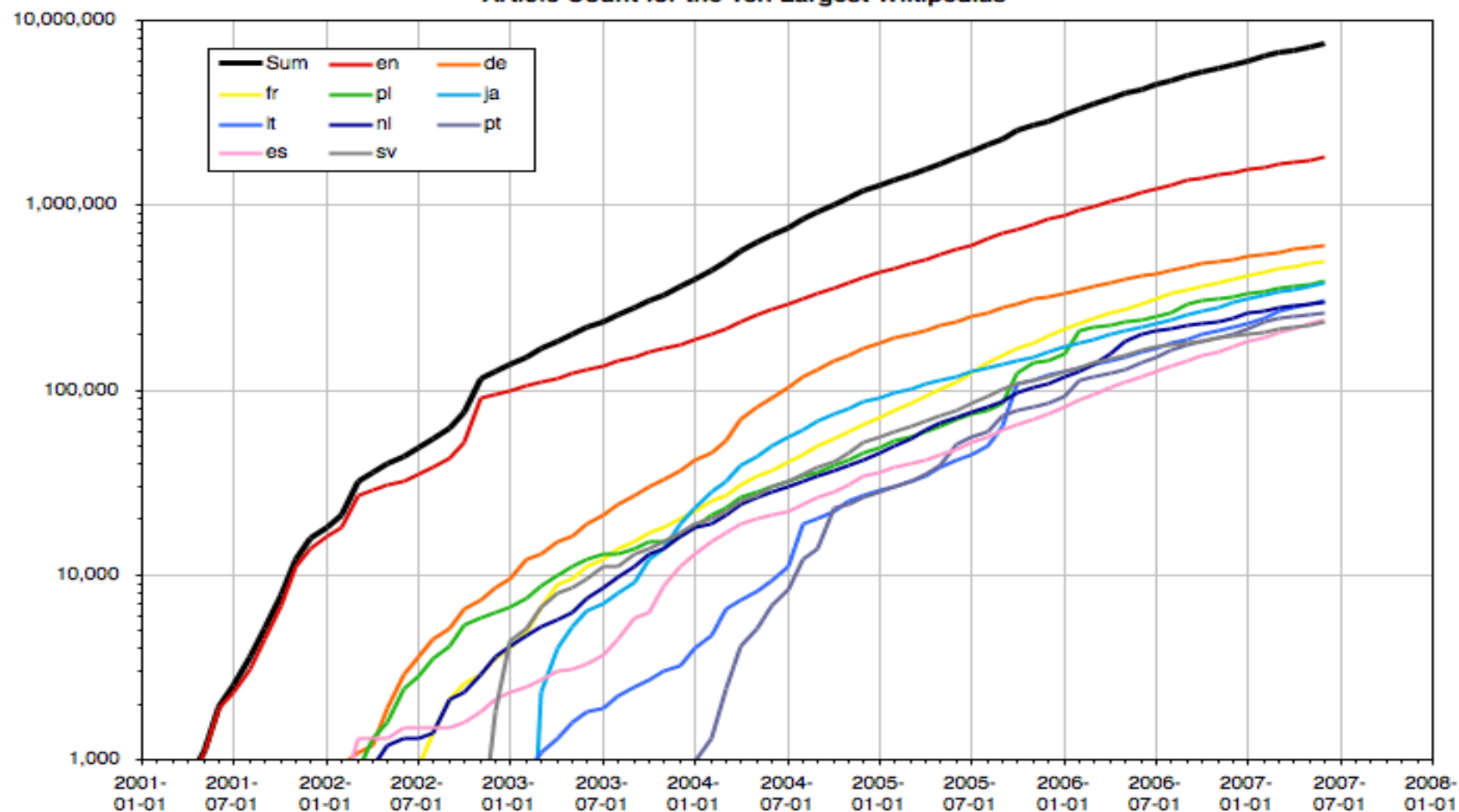
- Ontologiebasierte Expertensysteme
- Semantic MediaWiki
- Semantische Suche
- Verwendung von Ontologiesprachen z.B. für
 - ⇒ Life Sciences
 - ⇒ Standardisierungen
 - ⇒ Weblogs
 - ⇒ Semantische Portale
 - ⇒ Metadaten in Datenformaten

Semantic MediaWiki (SMW)

- MediaWiki: Software verwendet in Wikipedia
 - ⇒ editieren mit Browser
 - ⇒ einfache Syntax
 - ⇒ einfacher Wissensaustausch
- Wikis sind heute vielfältig im Gebrauch
 - ⇒ Viele Wikis im WWW zu verschiedensten Themen
 - ⇒ Wissensmanagement in Unternehmen
 - ⇒ Webportale von Forschergruppen
- SMW ist eine semantische Erweiterung der MediaWiki Software

Wikipedia growth

Article Count for the Ten Largest Wikipedias



Wikipediauser (Englische Version)

- 8.6 Mio registrierte User
- Ca. 150,000 aktive user
- Wikipedia gibt es in mehr als 260 Sprachen

- Breite Nutzerbasis stellt Hauptanteil der Inhalte
- Kleine Gruppe kümmert sich um "gardening"

Ein Wikipediaproblem



- Wiederverwendung von Inhalten kann nur manuell erfolgen.
- Wikipedia hat viele manuell erstellte Listen mit überlappenden Inhalten.
- Wartung dieser Listen kommt mit großem overhead bzgl. Qualität und Konsistenz.
- Semantische Technologien sind dazu gemacht, solche Schwierigkeiten zu lösen.

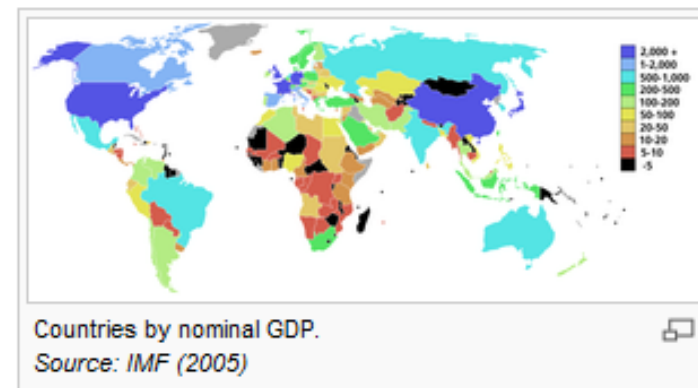
List of countries by GDP (nominal)

From Wikipedia, the free encyclopedia

This article includes a **list of countries of the world sorted by their gross domestic product (GDP)**, the value of all final goods and services produced within a nation in a given year. The GDP dollar estimates presented here are calculated at market or government official exchange rates.

The table below includes data for the year **2005** for all 181 members of the **International Monetary Fund**, for which information is available. **Data are in millions of current United States dollars.**

It should be noted these figures do not include [Somalia](#), [Cuba](#), [North Korea](#), [Iraq](#), and several small states in Europe ([Andorra](#), [Monaco](#), [San Marino](#), [Liechtenstein](#), [Vatican City](#), [Greenland](#)) and the Pacific ([Palau](#), [Marshall Islands](#), [Micronesia](#), [Nauru](#) and [Tuvalu](#)).



Rank	Country	GDP (millions of USD)
—	<i>World</i>	44,454,843
—	<i>European Union</i>	13,502,800
1	United States	12,455,825
2	Japan	4,567,441
3	Germany	2,791,737
4	People's Republic of China ²	2,234,133
5	United Kingdom	2,229,472
6	France	2,126,719
7	Italy	1,765,537

List of countries by GDP (nominal) per capita

From Wikipedia, the free encyclopedia

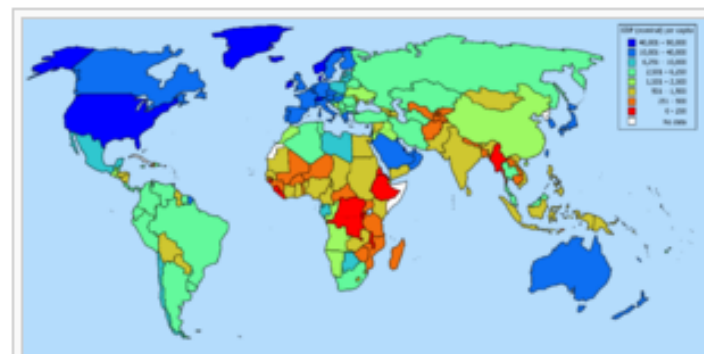
This article includes a **list of countries of the world sorted by their Gross Domestic Product (nominal) per capita**, the value of all final goods and services produced within a nation in a given year, divided by the average population for the same year.


The figures presented here do not take into account differences in the cost of living in different countries, and the results can vary greatly from one year to another based on fluctuations in the [exchange rates](#) of the country's [currency](#). Such fluctuations may change a country's ranking a great deal from one year to the next, even though they often make little or no difference to the standard of living of its population. Therefore these figures should be used with caution.

Comparisons of national wealth are also frequently made on the basis of [purchasing power parity](#) (PPP), to adjust for differences in the cost of living in different countries (See [List of countries by GDP \(PPP\) per capita](#)). PPP largely removes the exchange rate problem, but has its own drawbacks. It does not reflect the value of economic output in international trade, and it also requires more estimation than GDP per capita. On the whole PPP per capita figures are more narrowly spread than GDP per capita figures.

Great care should be taken when using either set of figures to compare the wealth of two countries. Often people who wish to promote or denigrate a country will use the figure that suits their case best and ignore the other one, which may be substantially different, but a valid comparison of two economies should take both rankings into account, as well as utilising other economic data to put an economy in context.

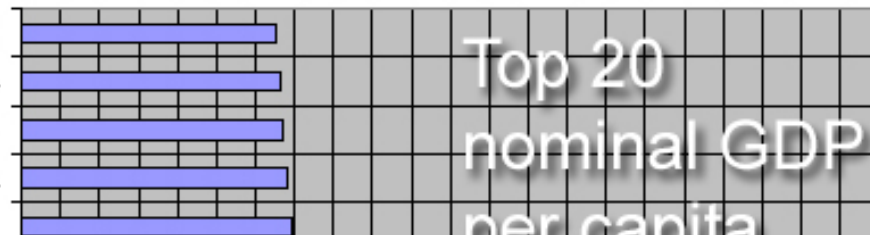
The table below includes data for the year [2005](#) for all 180 members of the [International Monetary Fund](#), for which information is available. Data are in [United States dollars](#).



Map of countries by GDP (nominal) per capita. Source:  IMF (2005)

Rank	Country	GDP per capita
1	Luxembourg	80,288
2	Norway	64,193

Kuwait
New Zealand
Singapore
Spain
UAE



List of countries by GDP (PPP)

From Wikipedia, the free encyclopedia

There are three **lists of countries of the world sorted by their gross domestic product (GDP)** (the value of all final goods and services produced within a nation in a given year). The GDP dollar estimates given on this page are derived from **Purchasing Power Parity (PPP)** calculations. Using a PPP basis is arguably more useful when comparing differences in living standards because PPP takes into account the relative cost of living and the inflation rates of the countries, rather than using just exchange rates which may distort the real differences in income. The **Market Exchange Rate (MER)** GDP is more useful for understanding the international economic purchasing power and the total value of tradeable goods and services of different countries.

- The first table includes data for the year **2005** for all 180 members of the **International Monetary Fund**, excluding **East Timor** for which information is not available, and the unranked entities: **world** and **European Union**. Data is in millions of **international dollars** and is calculated by the **International Monetary Fund**.
- The second table shows 162 national entities as well as figures for the **European Union** and the World. This list was compiled by the World Bank. Data is for the year 2005, with figures in millions of **international dollars**.
- The third table is a tabulation of the **CIA World Factbook** data update of April 2006, according to the data provided by the **CIA**. Figures are estimates in millions of international dollars, for various years ranging from **1993** to **2005** (most figures are however for the year 2005).

List by the International Monetary Fund

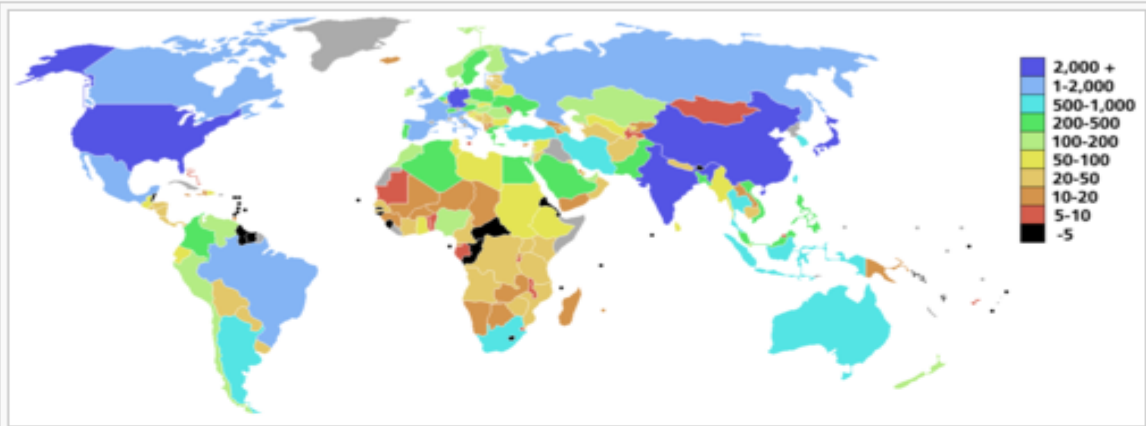
Rank	Country	GDP (PPP) <div>\$m</div>
—	World	61,027,505
—	European Union	12,427,413
1	United States	12,277,583

List by the World Bank

Rank	Country	GDP (PPP) <div>\$m</div>
—	World	61,006,604
—	European Union	12,626,921
1	United States	12,409,465

List by the CIA World Factbook

Rank	Country	GDP (PPP) <div>\$m</div>
—	World	60,630,000
1	United States	12,310,000
—	European Union	12,180,000



Map of world GDP (PPP) by country using the IMF list for 2005



List of countries by GDP (PPP) per capita


From Wikipedia, the free encyclopedia

This article includes a **list of countries of the world sorted by their gross domestic product (GDP) at purchasing power parity (PPP) per capita**, the value of all final goods and services produced within a nation in a given year divided by the average population for the same year.

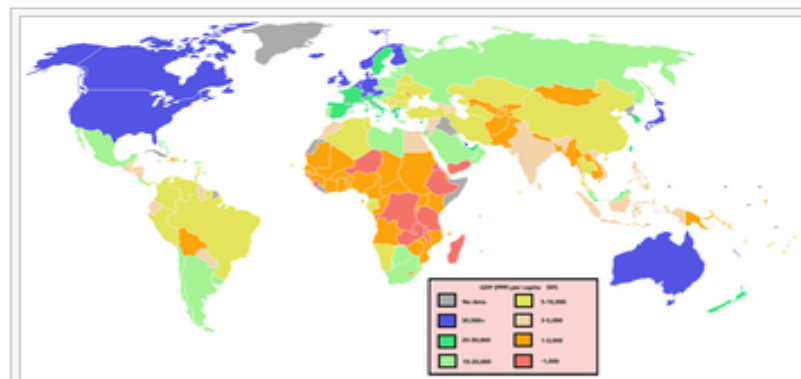
GDP dollar estimates here are derived from [purchasing power parity](#) (PPP) calculations. Such calculations are prepared by various organisations, including the [International Monetary Fund](#), the [University of Pennsylvania](#), and the [World Bank](#). As estimates and assumptions have to be made, the results produced by different organisations for the same country tend to differ, sometimes substantially. PPP per capita figures are estimates rather than hard facts, and should be used with caution.


Comparisons of national wealth are also frequently made on the basis of nominal GDP, which does not reflect differences in the cost of living in different countries. (See [List of countries by GDP \(nominal\) per capita](#).) The advantages of using nominal GDP figures include that less estimation is required, and that they more accurately reflect the participation of the inhabitants of a country in the global economy. On the whole PPP per capita figures are more narrowly spread than GDP per capita figures.

Great care should be taken when using either set of figures to compare the wealth of two countries. Often people who wish to promote or denigrate a country will use the figure that suits their case best and ignore the other one, which may be substantially different, but a valid comparison of two economies should take both rankings into account, as well as utilising other economic data to put their economies into context.

The table below includes data for the year [2005](#) for all 181 members of the [International Monetary Fund](#), for which information is available. Data are in [International dollars](#). The table excludes [Bermuda](#) which is one of the [British overseas territories](#). Bermuda has the highest GDP PPP in the world at \$69,900 (2004 est.) according to the [CIA Worldfact book](#). 

Rank	Country	GDP (PPP) \$ per capita
1	Luxembourg	69,800
2	Norway	42,364
3	United States	41,399

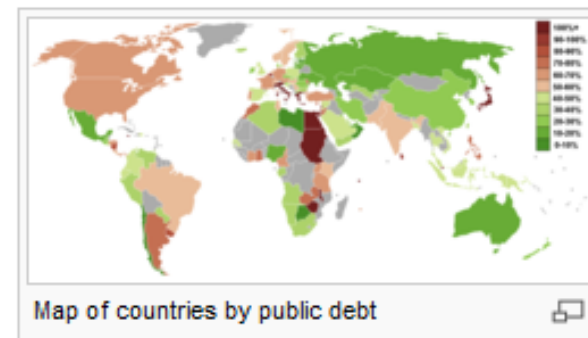


Map of countries by GDP (PPP) per capita, based on the [2005 IMF](#) data. 

List of countries by public debt

From Wikipedia, the free encyclopedia

This is a **list of countries by public debt** as percentage of **gross domestic product**, based on **The World Factbook**. For informational purposes several non-sovereign entities are also included in this list. All data per country is from a 2005 estimate, unless otherwise noted. Note that not all countries are included in the CIA data.



Nations by Public Debt		
Rank	Nation	Public debt (% of GDP)
1	Malawi	195.90
2	Lebanon	180.50
3	Seychelles	167.00
4	Japan	158.00
5	Jamaica	128.70
6	Zimbabwe	109.80
7	Italy	108.80
8	Sudan	107.00
9	Greece	106.80
10	Egypt	104.70
11	Singapore	102.90
12	Israel	99.70
13	Belgium	94.30
14	Sri Lanka	92.80

List of countries by military expenditures

From Wikipedia, the free encyclopedia

To meet Wikipedia's **quality standards**, this article or section may require **cleanup**.

Please discuss this issue on the [talk page](#), or replace this tag with a [more specific message](#). [Editing help](#) is available.

This article has been tagged since **June 2006**.

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Stockholm International Peace Research Institute Figures

[\[edit\]](#)

This is a **list of the fifteen countries with the highest defence budgets** for the year 2005. The information is the most up-to-date from the [Stockholm International Peace Research Institute](#), which is used to calculate defense spending by the British Ministry of Defence and many other government ministries in the European Union. Total World spending amounted to \$1.0 trillion in 2005, with about half of the total amount spent by the [United States](#).

Rank		Country	Defence Budget, USD	Date of information
—		World Total	1,000,000,000,000	2005
1		United States	478,200,000,000	2005
		European Union	216,961,000,000	2006 est.
2		United Kingdom	60,641,903,700	2006/07
3		France	46,200,000,000	2005

List of countries by population

From Wikipedia, the free encyclopedia

See also: *List of countries by population in 2005*, *List of countries by population in 1907*

This is a **list of sovereign states and other territories by population**, using the most recently available official figures. Because such figures are not collected at the same time in every country, or with the same level of accuracy, the resulting rankings may be misleading. The list includes all sovereign states and **dependent territories** recognized by the **United Nations** plus the 7 sovereign states that are not recognised by the United Nations.^[1]

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List of countries by population








[edit]

Rank	Country / Territory	Population	% of World Population	Notes
—	<i>World</i>	6,560,000,000	100%	population clock
1	 People's Republic of China ^[2]	1,314,100,000	20.03%	population clock ^[3]
2	 India	1,120,000,000	17.07%	population clock ^[4]
3	 United States	300,300,000	4.58%	population clock
4	 Indonesia	233,400,000	3.56%	population clock
5	 Brazil	187,650,000	2.86%	population clock
6	 Pakistan	158,750,000	2.42%	population clock

List of countries by length of coastline

From Wikipedia, the free encyclopedia

This is a **list of countries by length of coastline**, in **kilometers**, based on data for the year 2005 by the CIA World Factbook. ^[1]  Coastline of 0 indicates that the country is **landlocked**. However, because **length of coastline** is a **fractal** measurement, measurements of a country's coastline at different scales will be different - the more detail, the longer the coastline will be. This is why there are different amounts given for a country's coastline.

Rank	Country	Land area (km²)	Land boundary (km)	Coastline (km)	Total perimeter (km)	Coast/Area Ratio (m/km²)	Coast/Perimeter Ratio (%)
1	 Canada	9,220,970	8,893	202,080	210,973	21.915	95.8%
2	 Norway	324,220	2,515	83,281	85,796	256.866	97.1%
3	 Indonesia	1,826,440	2,830	54,716	57,546	29.958	95.1%
4	 Russia	16,995,800	19,917	37,653	57,570	2.215	65.4%
5	 Philippines	298,170	-	36,289	36,289	121.706	100.0%
6	 Japan	374,744	-	29,751	29,751	79.390	100.0%
7	 Australia	7,617,930	-	25,760	25,760	3.381	100.0%
8	 United States	9,158,960	12,219	19,924	32,143	2.175	62.0%
9	 New Zealand	268,680	-	15,134	15,134	56.327	100.0%
10	 Greece	130,800	1,160	14,880	16,040	113.761	92.8%
11	 People's Republic of China	9,326,410	22,147	14,500	36,647	1.555	39.6%
12	 United Kingdom	241,590	360	12,429	12,789	51.447	97.2%
13	 Mexico	1,923,040	4,538	9,330	13,868	4.852	67.3%
14	 Italy	294,020	1,932	7,600	9,532	25.849	79.7%

List of countries receiving snowfall

From Wikipedia, the free encyclopedia

Main article: [Snow](#)

This is a **list of countries receiving snow**.

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At or below 1,000 meters above [Sea Level](#)

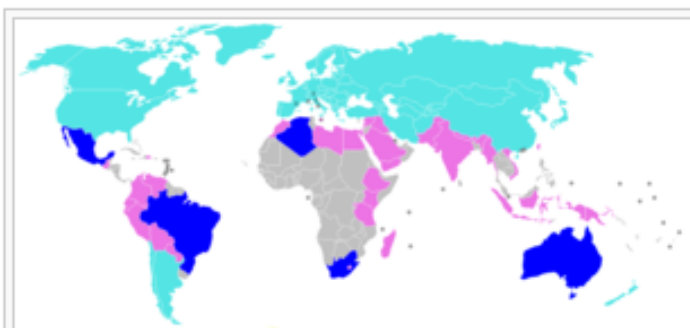
[\[edit\]](#)


Europe

[\[edit\]](#)

(every country except [Malta](#))

- [Albania](#)
- [Andorra](#)
- [Austria](#)
- [Belarus](#)
- [Belgium](#)
- [Bosnia-Herzegovina](#)
- [Bulgaria](#)
- [Croatia](#)
- [Czech Republic](#)
- [Denmark](#)
- [Estonia](#)
- [Finland](#)
- [France](#)
- [Georgia](#)
- [Germany](#)
- [Greece](#)



Cyan = snows at 1000m or below; Blue = may snow at or below 1000m, but very rarely; Magenta = only snows higher than 1000m 

Einfacheres Wikipedia- Management



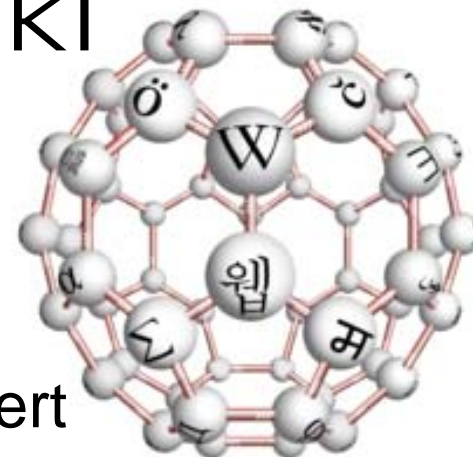
- Wir hätten gerne:
- Für jedes Land sollte alle relevante Information auf einer einzigen Seite zu finden sein.
- Automatische Erstellung von Listen aus diesen Inhalten.

Semantic Mediawiki



- Erweiterung der Mediawiki (wie z.B. für Wikipedia genutzt)
- Einfache Techniken der Wissensrepräsentation
- Mehrwert für den Nutzer, insbesondere
 - ⇒ einfachere und flexiblere Wiederverwendung von Inhalten
 - ⇒ besseres querying

Semantic MediaWiki



- Idee: Wiki-interne Links werden typisiert
 - ⇒ z.B. Link von Veröffentlichung zu Autor bekommt Typ "Has Author"
- Ermöglicht u.a.
 - ⇒ Wiki-interne Suche mit Metadaten
 - ⇒ flexible Erstellung von Listen
 - ⇒ interne Strukturierung
 - ⇒ inter-Wiki Konsistenz
 - ⇒ externe Wiederverwendung der Inhalte

Grundidee



- Repräsentation
 - ⇒ Semantic MediaWiki erweitert das MediaWiki markup durch einfache Verwendung von Metadaten
 - ⇒ RDF export
- Die Erweiterung besteht aus
 - ⇒ ***typisierten* Links**
 - ✧ Vorher: ... Karlsruhe is located in [[Germany]] ...
 - ✧ Jetzt: ... Karlsruhe is located in [[has location::Germany]] ...
 - ⇒ **Annotationen**
 - ✧ Vorher: ... Karlsruhe has 280.000 inhabitants ...
 - ✧ Jetzt: ... Karlsruhe has [[inhabitants:=280000]] ...



navigation

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search

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toolbox

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- [Permanent link](#)
- [Browse properties](#)

Tim Berners-Lee

Sir Tim Berners-Lee is the inventor of the Web and the director of [W3C](#). Moreover, he holds a chair at [CSAIL](#) (MIT). If you do not know about Sir Tim Berners-Lee, you should probably [look him up in Wikipedia](#).

Timothy Berners-Lee [vCard](#)timbl@w3.orgAffiliation: [W3C](#)Homepage: [at w3c](#)See also: [FOAF](#)Category: [Person](#)

Tim Berners-Lee - Mozilla Firefox

Datei

Bearbeiten

Ansicht

Chronik

Lesezeichen

Extras

Hilfe

Zurück

Vor

Neu laden

Stop

Startseite

Drucken

http://semanticweb.org/wiki/Special:Browse/Tim_Berners-2DLee

Google

Tim Berners-Lee - semanticwe...

Tim Berners-Lee

Property:Has author - semanti...

The Semantic Web - semantic...

Editing The Semantic Web - se...

User:Pascal Hitzler - semantic...

Pascal Hitzler

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Tim Berners-Lee

Affiliation

W3C + ⓘ

Email

timbl@w3.org ⓘ + 🔍

Foaf:mbox

timbl@w3.org ⓘ + 🔍

Homepage

http://www.w3.org/People/Berners-Lee/ ⓘ + 🔍

Member of

W3C + ⓘ, CSAIL + ⓘ, MIT + ⓘ

Name

Timothy Berners-Lee + 🔍

See also

http://www.w3.org/People/Berners-Lee/card ⓘ + 🔍

Categories

Person + ⓘ

hide properties that link here

Michael Hausenblas + ⓘ

Foaf:knows

The Semantic Web + ⓘ

Has author

Enter the name of the page to start browsing from.

Tim Berners-Lee

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watch

The property **has author** relates a [paper](#) or similar publication to each of its authors. Its inverse is [property:wrote](#) or [property:writing](#) for work still in progress.

This property has the following 2 subproperties.

- Author

- Written by

(previous 25) (next 25)

Pages using the property "Has author"

Showing 25 pages using this property.

A

A Survey of the Web Ontology Taowei Wang + , Bijan Parsia + , Jim Hendler + Landscape + AceRules + AceWiki + ActiveRDF + Artificial Memory +

Tobias Kuhn + 🔍

Tobias Kuhn + , Loic Royer +

Eval Oren + 🔍

Lars Ludwig + 🔍



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The Semantic Web

The Semantic Web is an article written by [Tim Berners-Lee](#), [James Hendler](#) and [Ora Lassila](#) published in the May 2001 issue of [Scientific American](#). It describes how the Web of the future will cope with meaning and offers a number of scenarios.

It is the canonical citation for the [Semantic Web](#).

Link

[\[edit\]](#)

- [Read the paper](#)
- [German translation](#)

Editing The Semantic Web



'''The Semantic Web''' is an article written by [[Has author::Tim Berners-Lee]], [[Has author::James Hendler]] and [[Has author::Ora Lassila]] published in the May 2001 issue of [[published in::Scientific American]]. It describes how the Web of the future will cope with meaning and offers a number of scenarios.

It is the canonical citation for the [[about::Semantic Web]].

== Link ==

* [http://www.sciam.com/article.cfm?articleID=00048144-10D2-1C70-84A9809EC588EF21
Read the paper]

* [http://www.spektrum.de/artikel/827866&_z=798888 German translation]

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	 Has author	 Accepted by
A Survey of the Web Ontology Landscape	Taowei Wang Bijan Parsia Jim Hendler	ISWC2006
The Semantic Web	Tim Berners-Lee Jim Hendler Ora Lassila	

[\[edit\]](#)

	Has author	Accepted by
A Survey of the Web Ontology Landscape	Taowei Wang Bijan Parsia Jim Hendler	ISWC2006

User:Pascal Hitzler - semanticweb.org - Mozilla Firefox

DateiBearbeitenAnsichtChronikLesezeichenExtrasHilfe

ZurückVorNeu ladenStoppStartseiteDrucken

http://semanticweb.org/wiki/User:Pascal_Hitzler

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Webseite zu PDF

Tim Berners-Lee - semanticwe...Tim Berners-LeeProperty:Has author - semanti...The Semantic Web - semantic...Editing The Semantic Web - se...User:Pascal Hitzler - sem...

Semantic Web reasoners with stable releases

[edit]

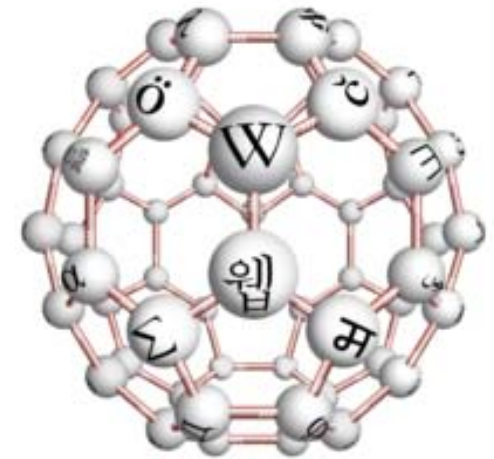
```
{{#ask: [[Category:Reasoner]] [[Status::stable]]
| ?Category
| ?Release date = Released
| ?License
| ?Affiliation=By
}}
```

	Category	Released	License	By
AllegroGraph	RDF store Reasoner	19 May 2008	Pay Licensed Closed Source	Franz Inc
FaCT++	Reasoner	28 March 2008	GPL	University of Manchester
Internet Business Logic	Ontology engineering tool Business Rule Ontology editor Ontology language Artificial Intelligence Query language Reasoner Semantic wiki	30 April 2008	Webapp, free shared use, also commercial subscription	Reengineering LLC
KAON2	Reasoner	14 January 2008	Pay Licensed Closed Source	University of Manchester FZI AIFB
OWLIM	Reasoner	10 September 2007		Ontotext
Pellet	Reasoner	1 May 2008	MIT license	Clark & Parsia
RacerPro	Reasoner	5 December 2005	Pay Licensed Closed Source	Racer Systems

Powered by

Semantic MediaWik

AIFB 



- Open Source. An vielen Stellen weltweit im praktischen Einsatz.
 - ⇒ Psychology Wiki (911905 pages)
 - ⇒ Recipes Wiki (141909 pages)
 - ⇒ ...

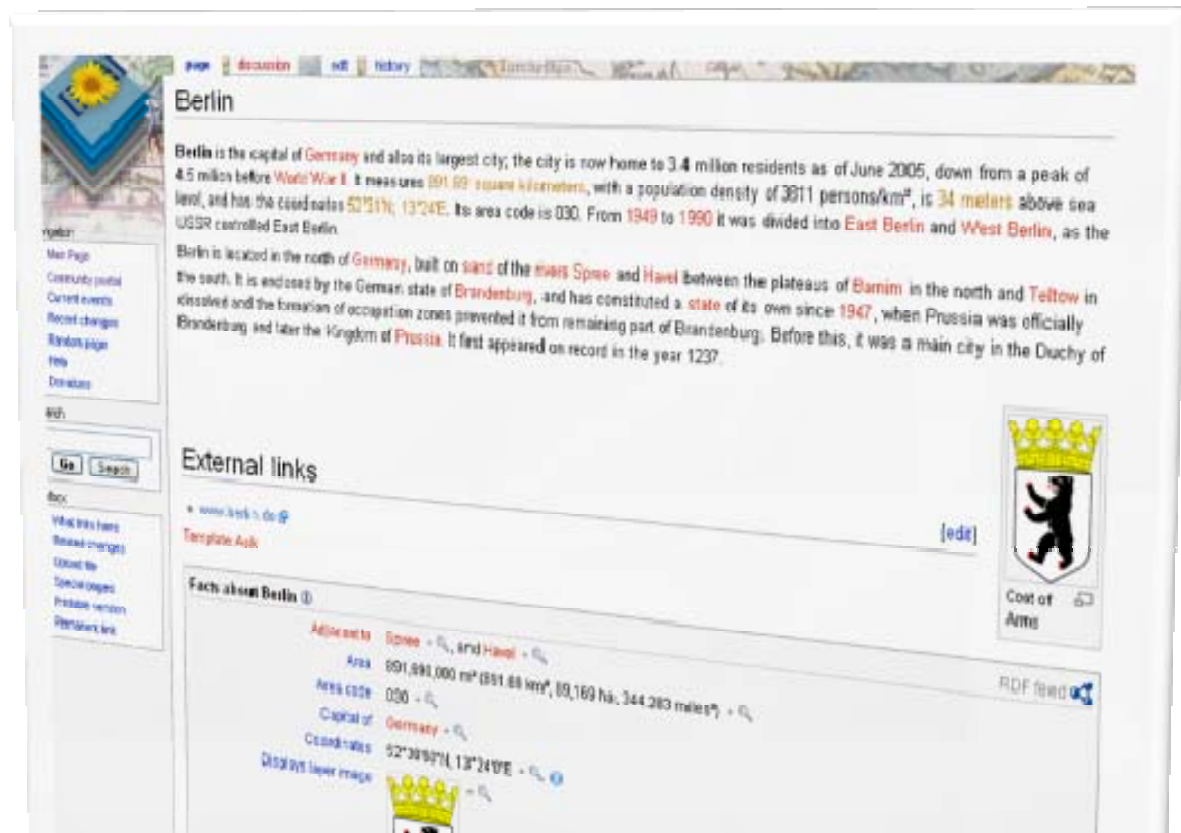
- Hauptentwickler:
Markus Krötzsch (AIFB Karlsruhe)



Anwendungsbeispiel: Service Mashups



- Semantische Erweiterung von MediaWiki die Typisierung von Links und die Annotation einer Seite mit Fakten.
 - ⇒ Karlsruhe is a city in [[country::Germany]] with an area of [[area::173.46 km²]].



Anwendungsbeispiel: Service Mashups

AIFB

German cities query

This is essentially the same example as the one on the Main Page, but uses a query instead of a predefined layer.

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Map data ©2008 PNMK, Tele Atlas, Strasbourg

The following wikitext was used to generate the above map.

```
{{#ask: [[Category:City]] [[Located in::Germany]]
| ?Coordinates
| ?Population
| ?Capital of
| format=map
| width=600
| height=400
| layers=+GoogleNormal({})-GoogleSatellite({})-GoogleHybrid({})
| startextent=3.5,47,16.5,55
| contentslabel=Cities in Germany
}}
```

http://s89238293.onlinehome.us/w/index.php?title=German_cities_query

Verknüpfen von Daten aus verschiedenen Quellen: Landkarte mit Wiki-Daten wird über den Web Service Google Maps generiert.

Verwendung von Ontologiesprachen



- Zurzeit entstehen im WWW große Mengen an Daten, die meist in RDF, manchmal in OWL abgelegt sind.
- Webstyle:
Wofür diese Daten genau benutzt werden, bleibt manchmal zunächst offen.
- Mittlerweile sind genug Daten da um auch interessante neue Dinge damit anfangen zu können.

RSS 1.0 (RDF Site Summary)



- Das am weitesten verbreitete Semantic-Web-Vokabular:
<http://web.resource.org/rss/1.0/spec>
- „RDF Site Summary“ (RSS 1.0)
≠ „Really Simple Syndication“ (RSS 2.0)
- Herausgegeben von der *RSS-DEV Working Group* 2000
- Übertragung von Listen aus (Hyper-)Texteinträgen
- Relevante Metadaten: Autor, Datum, Inhalt, . . .
- Erzeugung durch Blogs zur Übertragung von Newsfeeds
- Auswertung/Aggregation durch RSS-Feed-Reader

RSS 1.0 Beispiel



```
➤ <rdf:RDF>
➤   <channel>
➤     <title>News of the Research Group Knowledge Management</title>
➤     <link>http://www.aifb.uni-karlsruhe.de/WBS/english</link>
➤     <description>
➤       News of the research group Knowledge Management, AIFB Karlsruhe
➤     </description>
➤   </channel>
➤   <item>
➤     <title>"AI's 10 To Watch" nomination</title>
➤     <pubDate>12.06.2008</pubDate>
➤     <description>
➤       Philipp Cimiano has been nominated as one of "AI's 10 To Watch" in
➤       2008 by the IEEE Magazine. More information at
➤       http://www.computer.org/portal/site/intelligent
➤     </description>
➤   </item>
➤ </rdf:RDF>
```


FOAF: Friend of a Friend



- <http://www.foaf-project.org/>
- Vokabular für Personendaten und Social Networking
- Herausgegeben vom FOAF-Projekt (Libby Miller, Dan Brickley)
- seit 2000
- Heute (2008) etwa 900,000 FOAF-Beschreibungen im Netz,
- größtenteils automatisch erstellt
- Verschiedene Anzeigetools: FOAFexplorer, FOAFnaut, .
..
- Beschreibung des Vokabulars mittels RDF und OWL

Woher kommen FOAF-Files?



- FOAF wird größtenteils automatisch generiert, z.B. aus Nutzerprofilen
 - ⇒ Beispiel: AIFB-Portal
- Einige Tools zur direkten Erstellung.
 - ⇒ Beispiel: FOAF Creator, FOAF-a-matic

FOAF Beispiel



```
> <rdf:RDF>
>   <foaf:PersonalProfileDocument rdf:about="">
>     <foaf:maker rdf:resource="http://simia.net/foaf.rdf#denny"/>
>   </foaf:PersonalProfileDocument>
>   <foaf:Person rdf:about="http://simia.net/foaf.rdf#denny">
>     <foaf:name>Denny Vrandecic</foaf:name>
>     <foaf:openid rdf:resource="http://denny.vrandecic.de"/>
>     <owl:sameAs rdf:resource="http://www.aifb.uni-karlsruhe.de/Personen/
>                                   viewPersonOWL/id2097instance"/>
>     <foaf:givenname>Zdenko</foaf:givenname>
>     <foaf:family_name>Vrandecic</foaf:family_name>
>     <foaf:nick>denny</foaf:nick>
>     <foaf:homepage rdf:resource="http://denny.vrandecic.de"/>
>     <foaf:knows>
>       <foaf:Person rdf:about="http://ontoworld.org/wiki/
>                                   Special:URIResolver/Rudi_Studer">
>         <foaf:name>Rudi Studer</foaf:name>
>         <rdfs:seeAlso rdf:resource="http://www.aifb.uni-karlsruhe.de/
>                                   Personen/viewPersonFOAF/foaf_57.rdf"/>
>       </foaf:Person>
>     </foaf:knows>
>   </rdf:RDF>
```

Medizinische Ontologien



- Anwendungen komplexer Ontologien besonders in Medizin/Biologie
- Gene Ontology
 - ⇒ Domäne: Gene in allen Organismen
 - ⇒ Ontologiesprache: „OBO“, Abbildung auf OWL teilweise möglich
 - ⇒ Anwendung: Kombination von Gen-Daten
- SNOMED – Systematized Nomenclature of Medicine (Clinical Terms)
 - ⇒ Domäne: Krankheiten, Diagnosen, Medikamente, . . .
 - ⇒ Ontologiesprache: Beschreibungslogik EL++
 - ⇒ Anwendung: Informationsaustausch in Medizinanwendungen
- GALEN
 - ⇒ Domäne: Krankheiten (medizinische Klassifikation)
 - ⇒ Ontologiesprache „GRAIL“, Abbildung auf OWL teilweise möglich
 - ⇒ Anwendung?: „basis for teaching, training and services“ (Zitat)
- Formale Semantik hilft bei Ontologierstellung

Metadaten in Dateiformaten

- Einbettung semantischer Metadaten in existierende Dateiformate:
 - ⇒ Adobe XMP – Extensible Metadata Platform
RDF-basiertes Metadatenformat in Dateien
Verfügbar in Photoshop 7.0, Acrobat 5.0, Illustrator 10, . . .
 - ⇒ SVG (z.B. in Inkscape)
RDF-Daten in SVG (Scalable Vector Graphics, XML-basiert)
Einbettung von Metadaten Grafiken
- Semantik fest an existierende Dateiinhalte gekoppelt
- einfache Integration in bestehende IT-Prozesse

Semantische Portale



- Nicht alle Anwendungen semantischer Technologien exportieren Daten!
- Yahoo! Food
 - ⇒ Yahoo!-Portal zu Ernährung und Kochen
 - ⇒ interne Datenhaltung mit RDF
- Vodaphone Live! Mobile Portal
 - ⇒ Vodaphone-Portal für handy-Downloads
 - ⇒ interne Datenverwaltung mit RDF
 - ⇒ Verbesserung in der Suche: 50% weniger Seitenaufrufe pro Download

Semantische Websuche



- Websuche auf Basis von semantischen Dokumenten in Netz
- Yahoo! Creative Commons Search
 - ⇒ Suche nach Webinhalten auf Basis ihrer Lizenzbestimmungen
 - ⇒ Angabe von gewünschten Rechten (kommerzielle Nutzung, Bearbeitung)
 - ⇒ Basierend auf Annotationen in Creative-Commons-RDF-Vokabular (z.B. von Flickr)
- Aktuelle Forschung: Semantic-Web-Suchmaschinen
 - ⇒ Aggregation von semantischen Daten, crawling
 - ⇒ Suche nach technischen/strukturellen Merkmalen von Metadaten
 - ⇒ Beispiele: Swoogle, Sindice
 - ⇒ Meist relativ unvollständige Crawler, unvollständige Datensätze

Tools



- Siehe Vorlesung Semantic Web Technologies 2
- Ontologieeditoren
 - ⇒ Protégé: freier Ontologieeditor, Plugins/Erweiterungen
 - ⇒ Ontostudio: kommerzieller Editor
 - ⇒ Topbraid Composer: kommerzieller Editor
 - ⇒ NeOn-Toolkit: freier Editor mit kommerziellen Erweiterungen
- Systeme zum Umgang mit Ontologien/RDF-Daten:
 - ⇒ RDF-Datenbanken (RDF-Stores): Jena, Oracle 10g, RAP, Redland, Sesame, Virtuoso, . . .
 - ⇒ OWL-Reasoner: FACT++, HermiT, KAON2 (OntoBroker-OWL), Pellet, RacerPro, . . .
 - ⇒ Leicht-gewichtige OWL-Unterstützung: CEL, Oracle 11g, QuOnto, . . .

Lust auf Mehr?



- Bachelorarbeit, Masterarbeit, ...
- Hiwitätigkeit, z.B. Programmierung von Forschungsprototypen
- Weitere Lehrveranstaltungen
 - ⇒ Semantic Web Technologies 2
 - ⇒ Knowledge Discovery
 - ⇒ Seminare und Praktika
- ⇒ Siehe Webseite Lehrstuhl Wissensmanagement (Studer)

Literatur



Pascal Hitzler
Markus Krötzsch
Sebastian Rudolph
York Sure

Semantic Web Grundlagen

Springer 2008, 277 S., Softcover
ISBN: 978-3-540-33993-9

